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Sasaki

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(54) **RETAINING STRUCTURE OF FRONT HOLDER TO CONNECTOR HOUSING**

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(73) Assignee: **Yazaki Corporation**, Tokyo (JP)

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(51) **Int. Cl.**[7] **H01R 13/40**
(52) **U.S. Cl.** **439/595**; 439/752
(58) **Field of Search** 439/595, 752, 439/271

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(57) **ABSTRACT**

A retaining structure of a front holder and a connector housing, essentially consist of a housing body having a retaining portion, a holding arm having a retaining projection, and a flexible connection portion for supporting the holding arm so that the retaining projection can be engaged with the retaining portion, wherein the flexible connection portion supports the holding arm on a front end of the flexible connection portion in an inserting direction of the front holder into a housing body with respect to the retaining projection, the retaining projection is engaged with the retaining portion in a state where the front holder is retained to the housing body. If a force is applied in a direction releasing the engagement between the front holder and the housing body, the retaining projection abuts against the retaining portion so that the holding arm tries to rock in a direction opposite from the direction releasing the engagement. Therefore, the retained state between the front holder and the housing body is maintained.

5 Claims, 7 Drawing Sheets

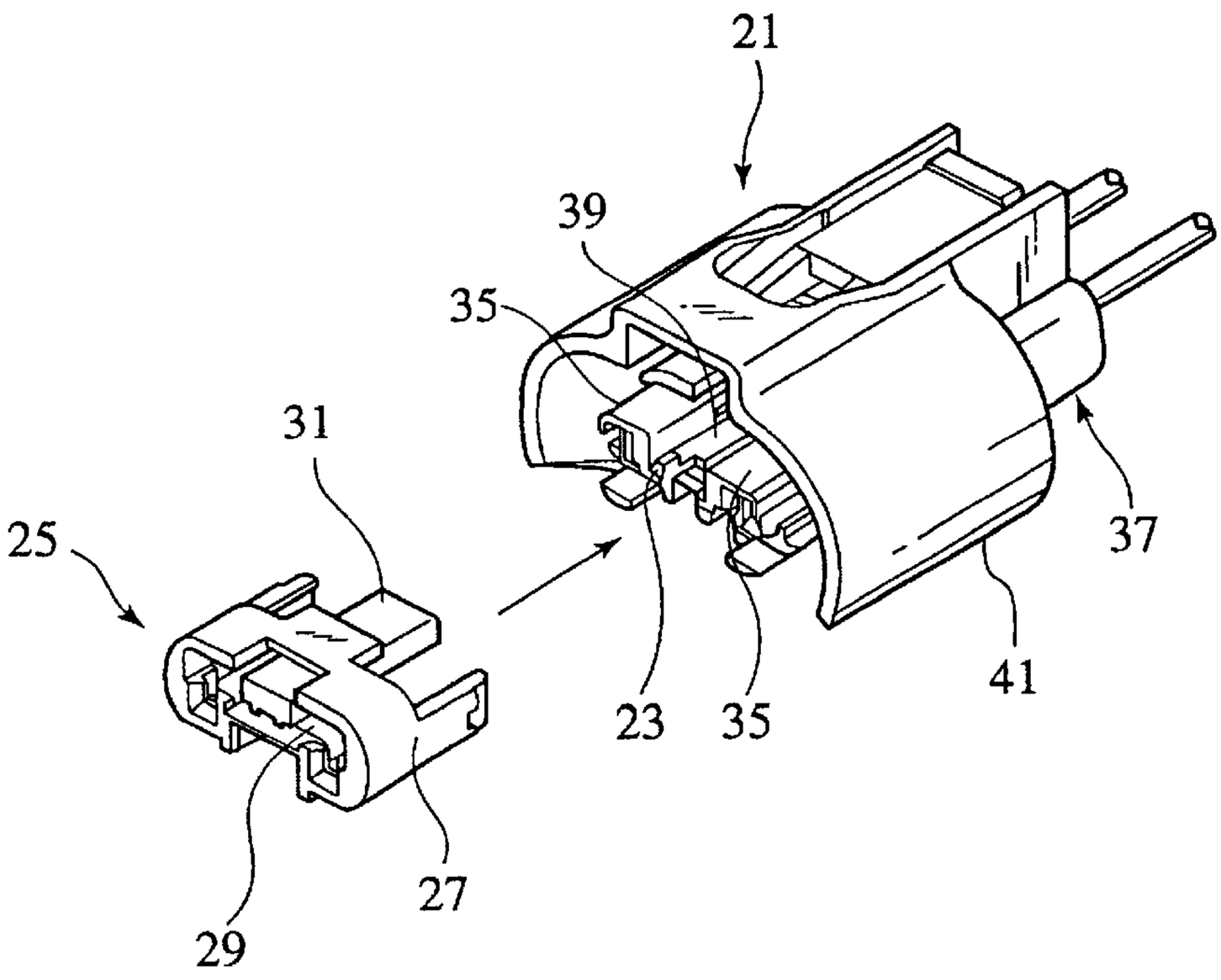

FIG.1

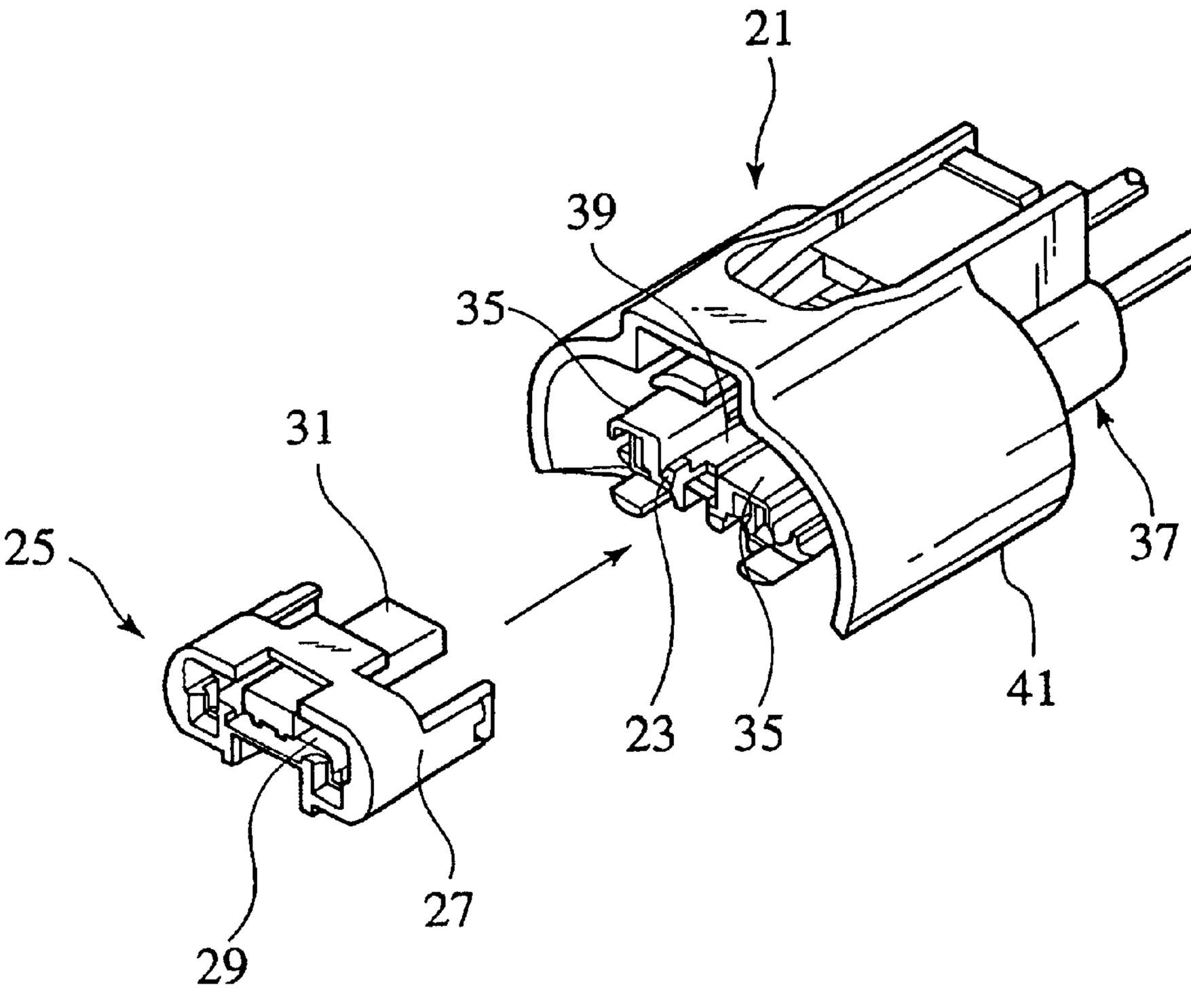

FIG.2

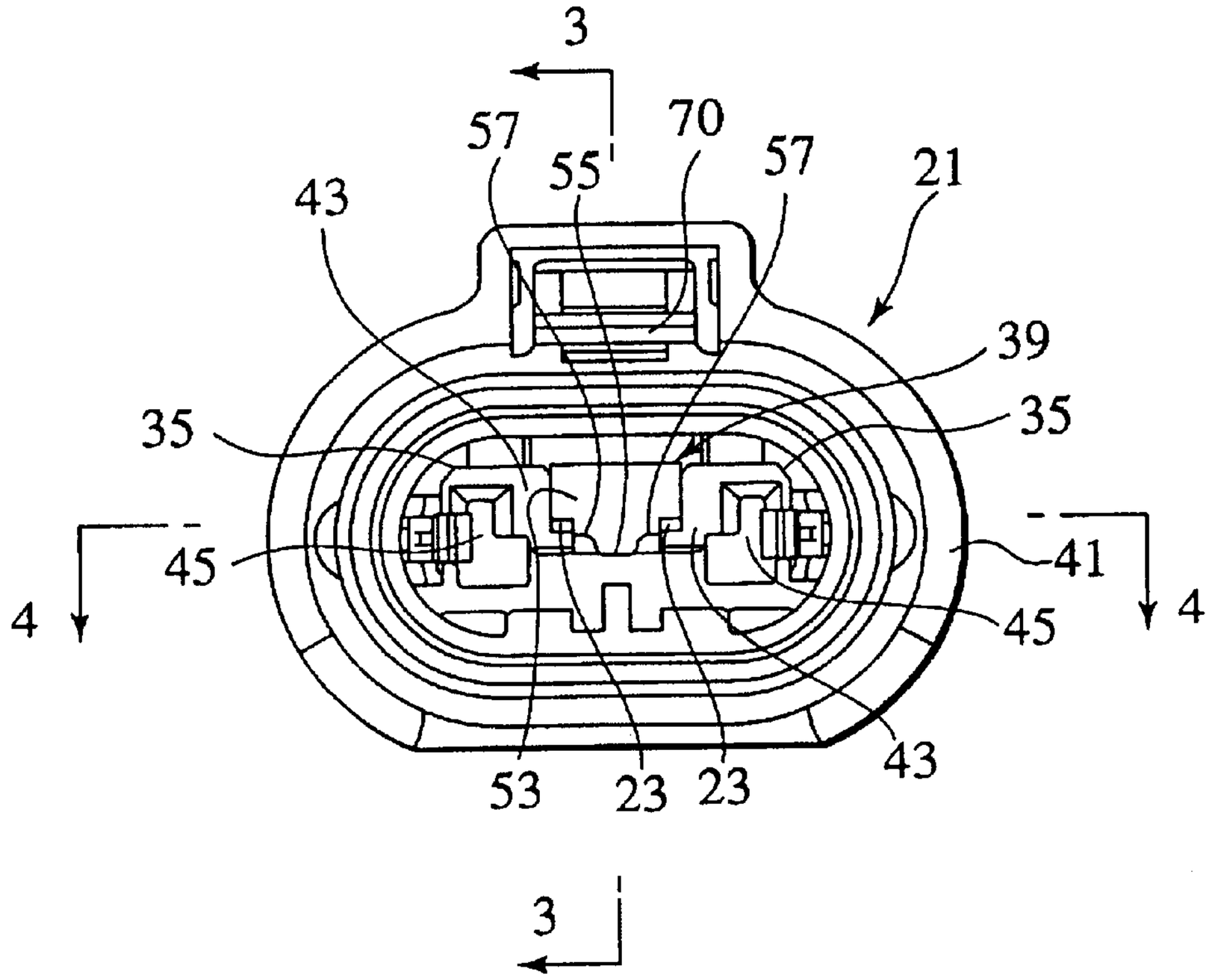
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FIG.3

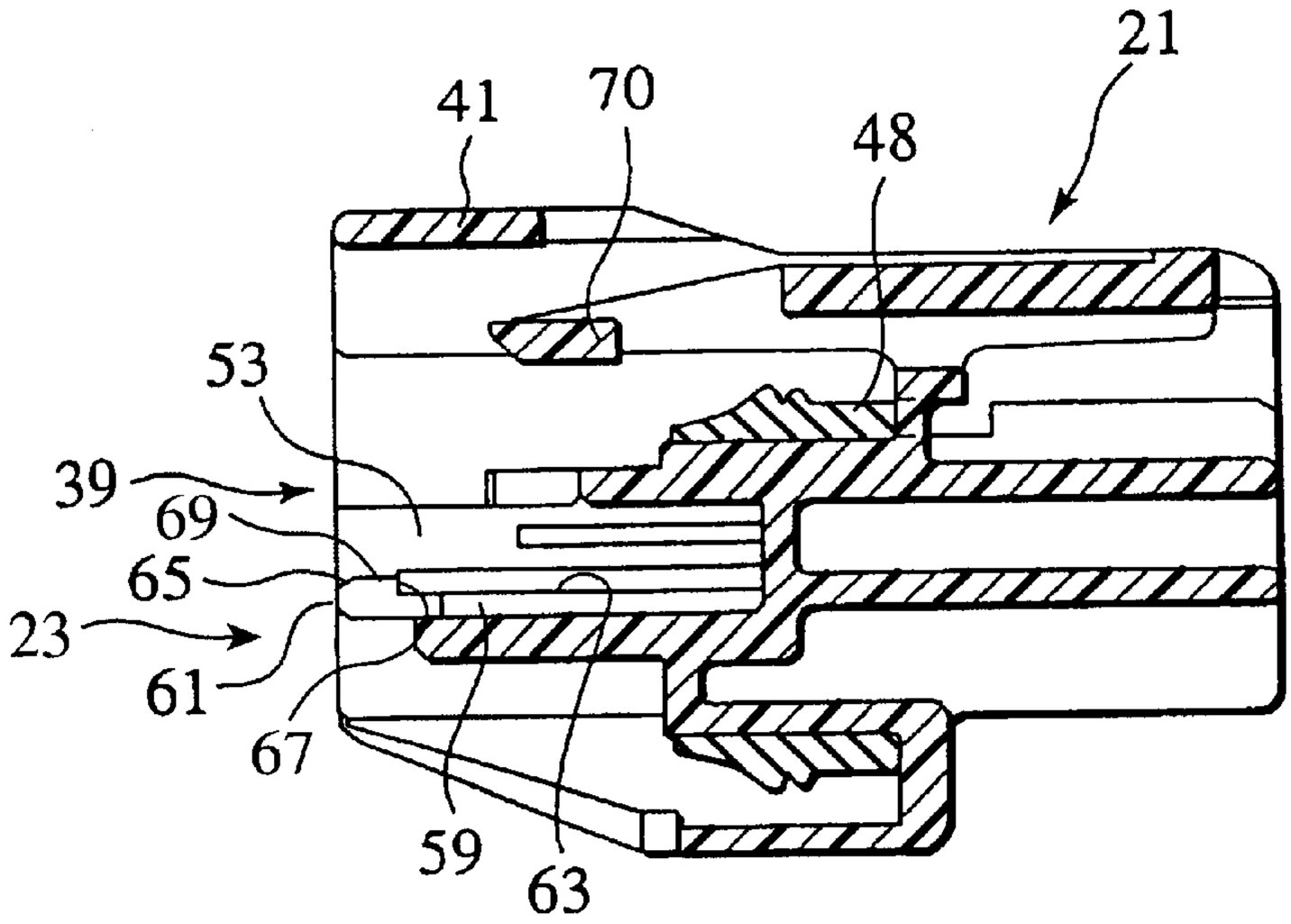
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FIG.4

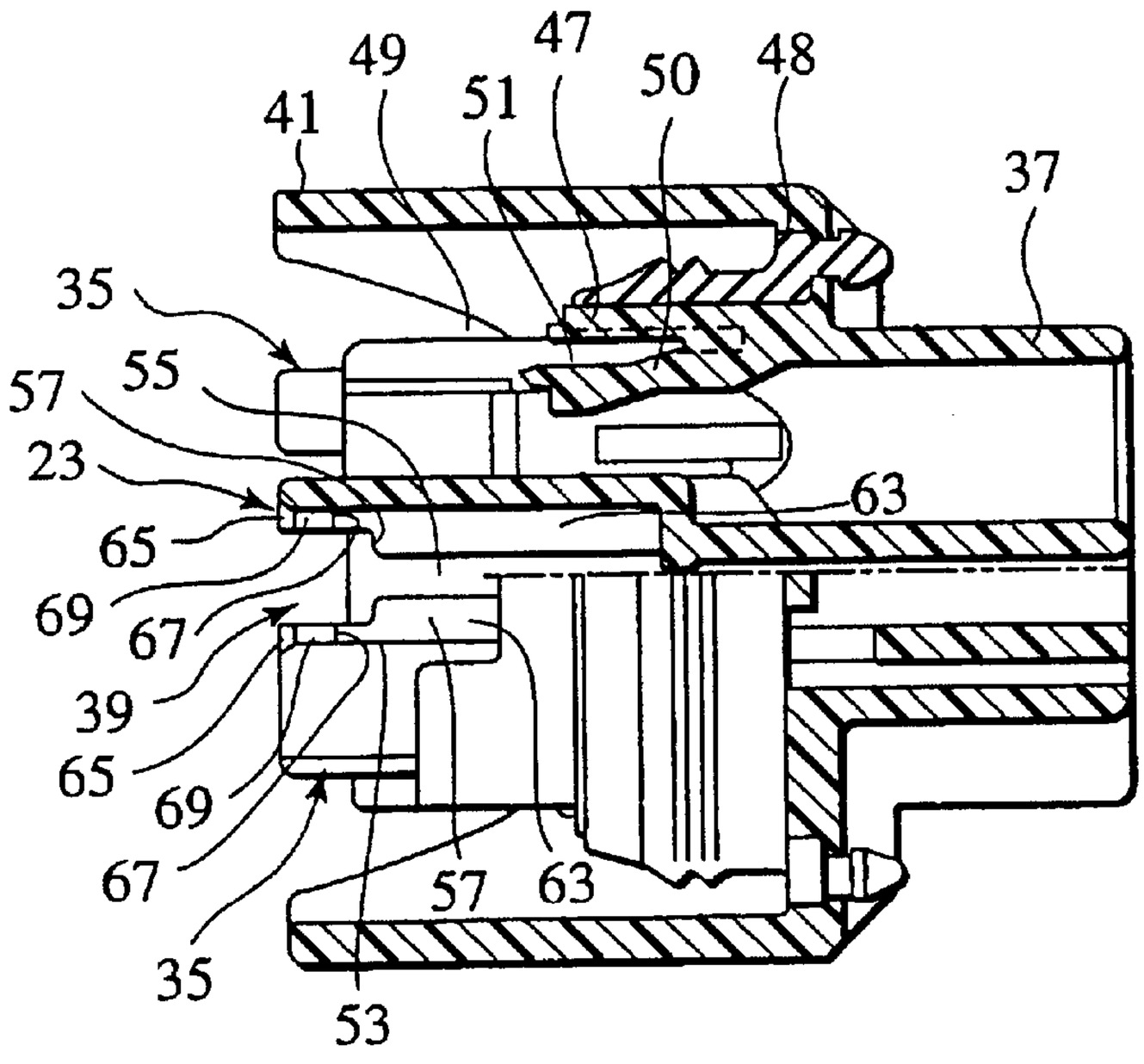
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FIG.5

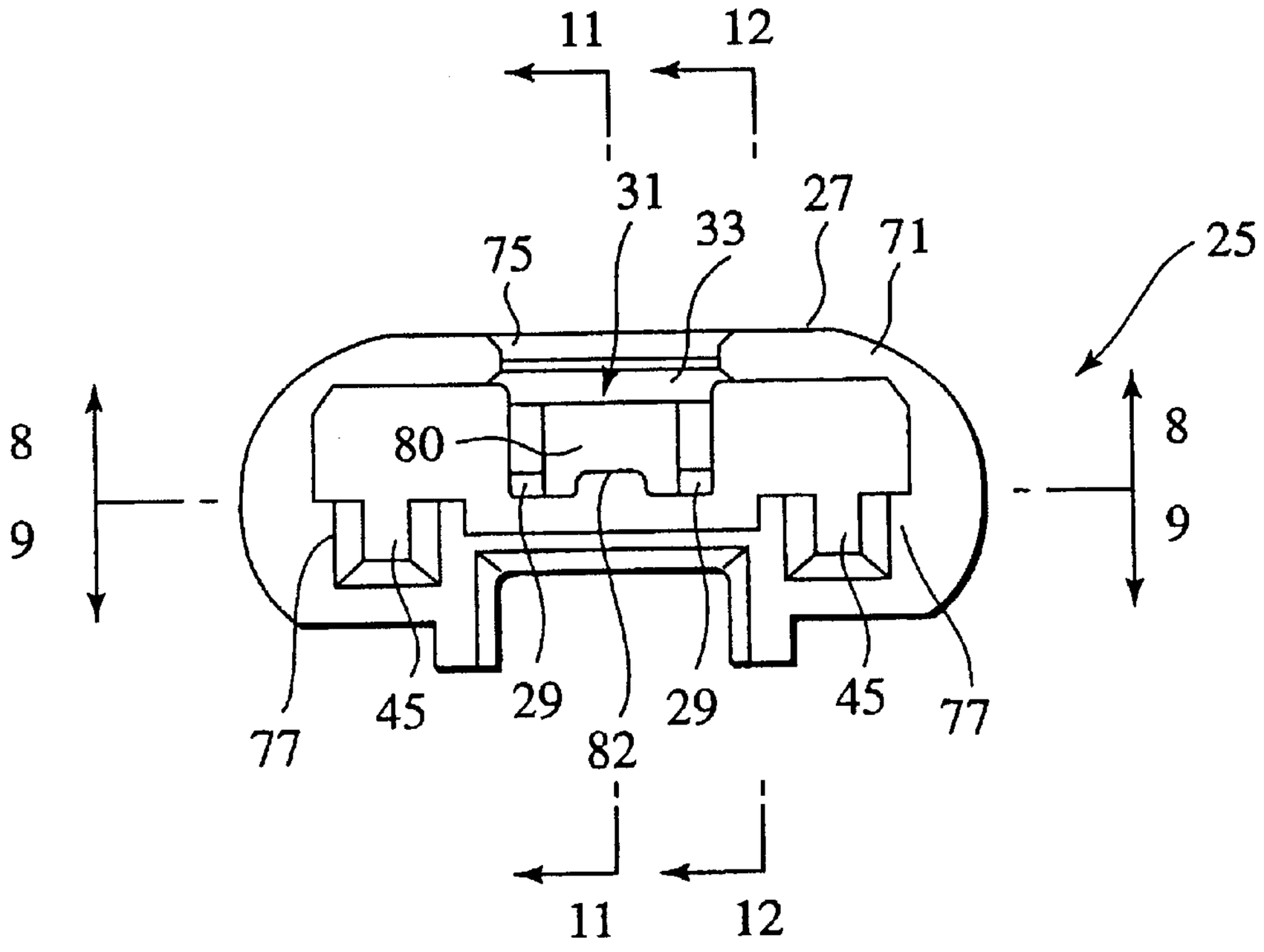
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FIG.6

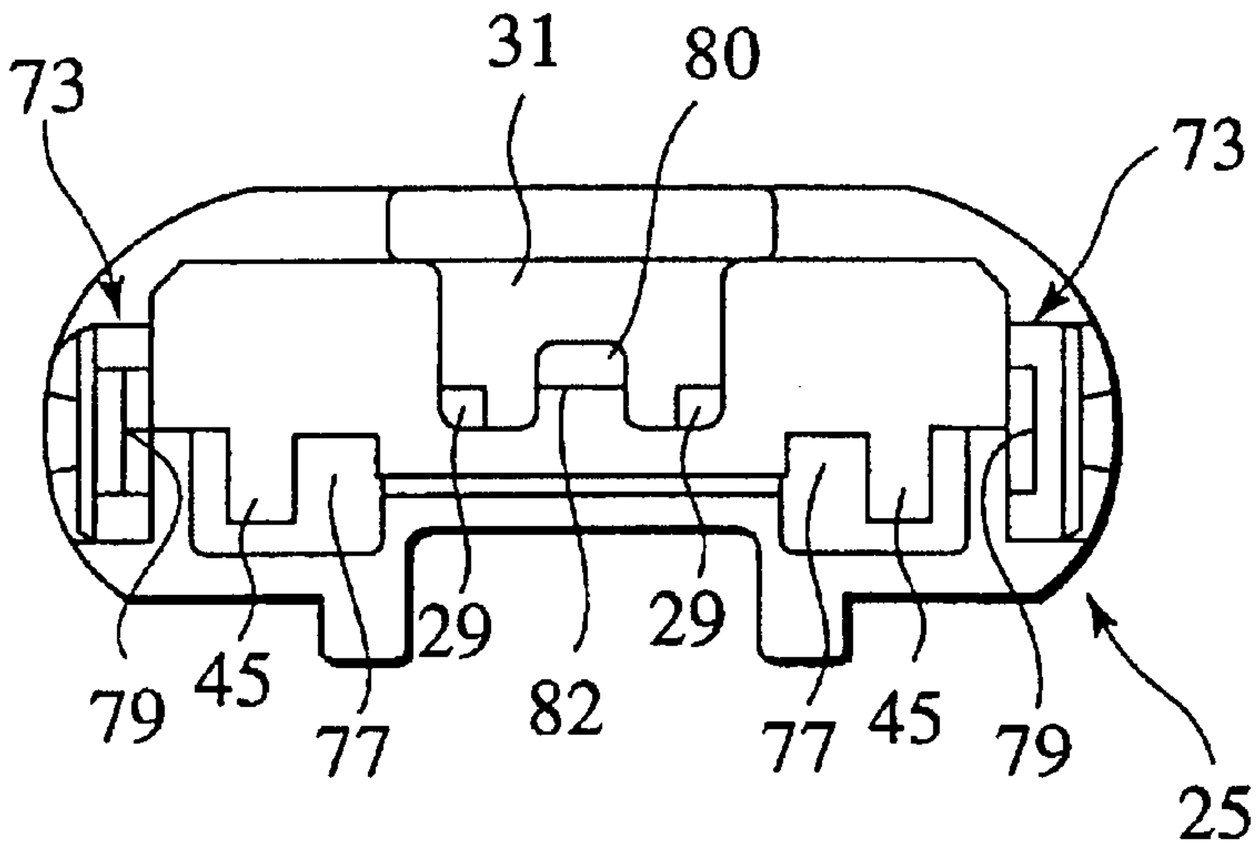

FIG.7

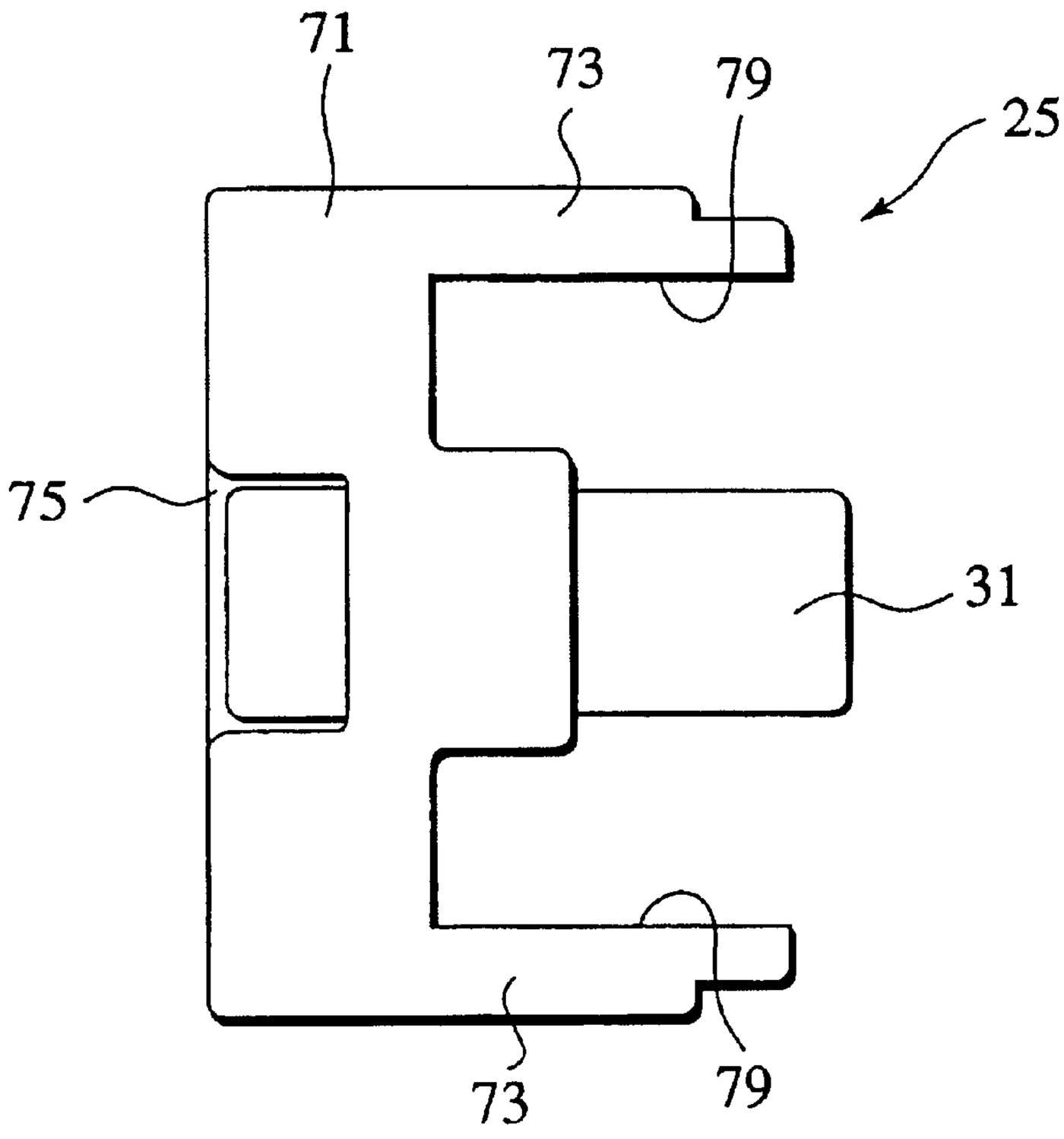

FIG.8

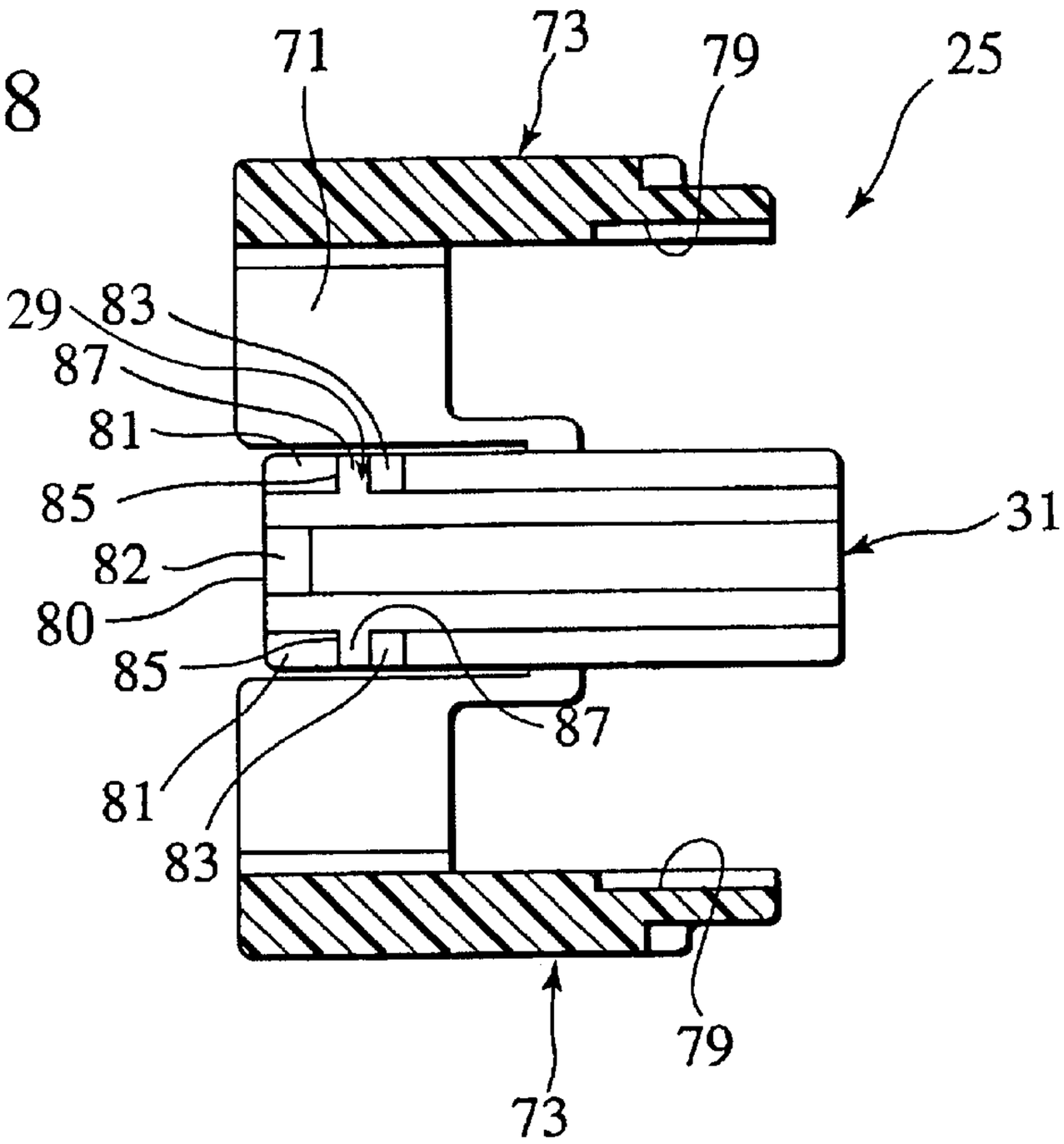
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FIG.9

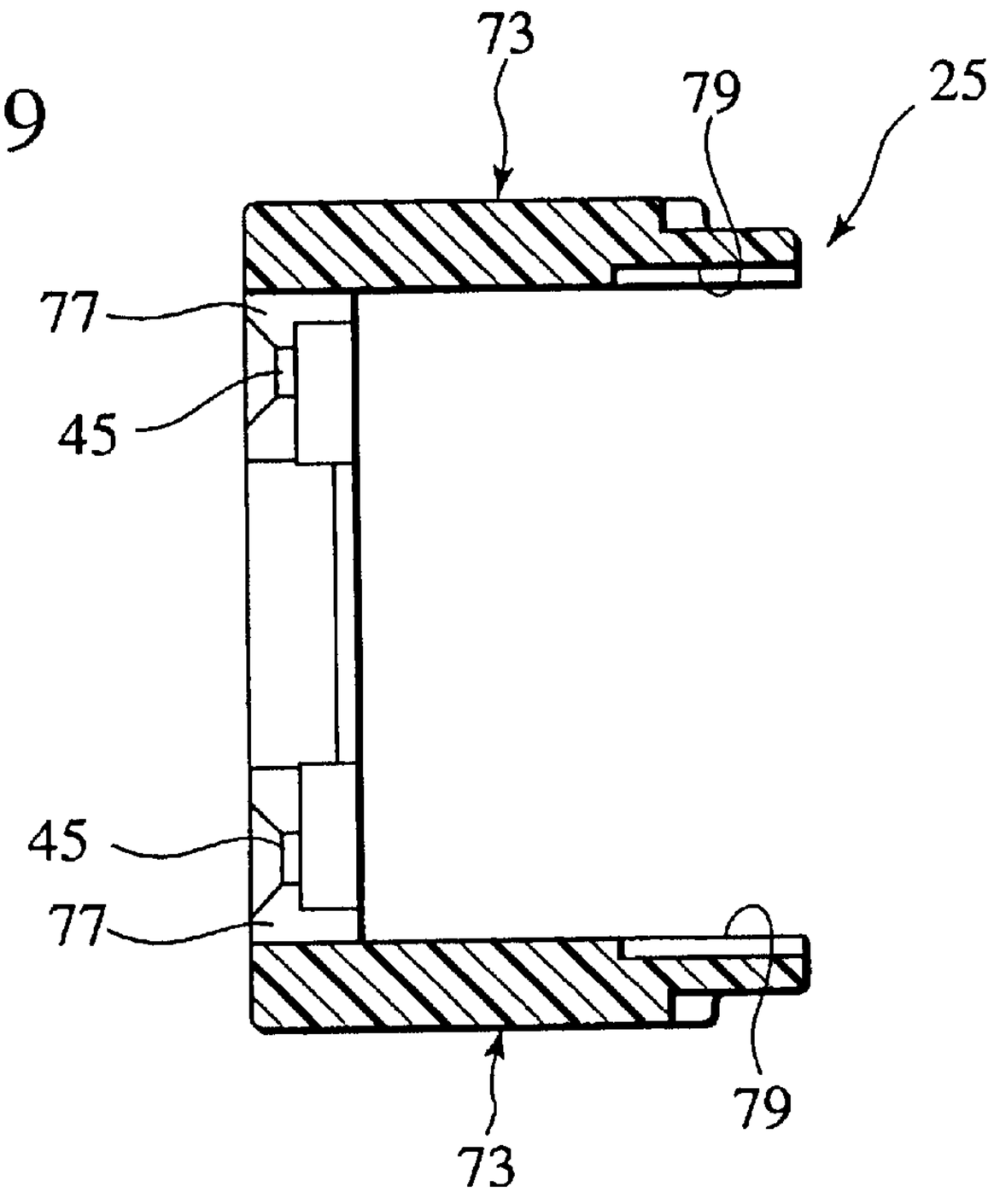
73
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FIG.10

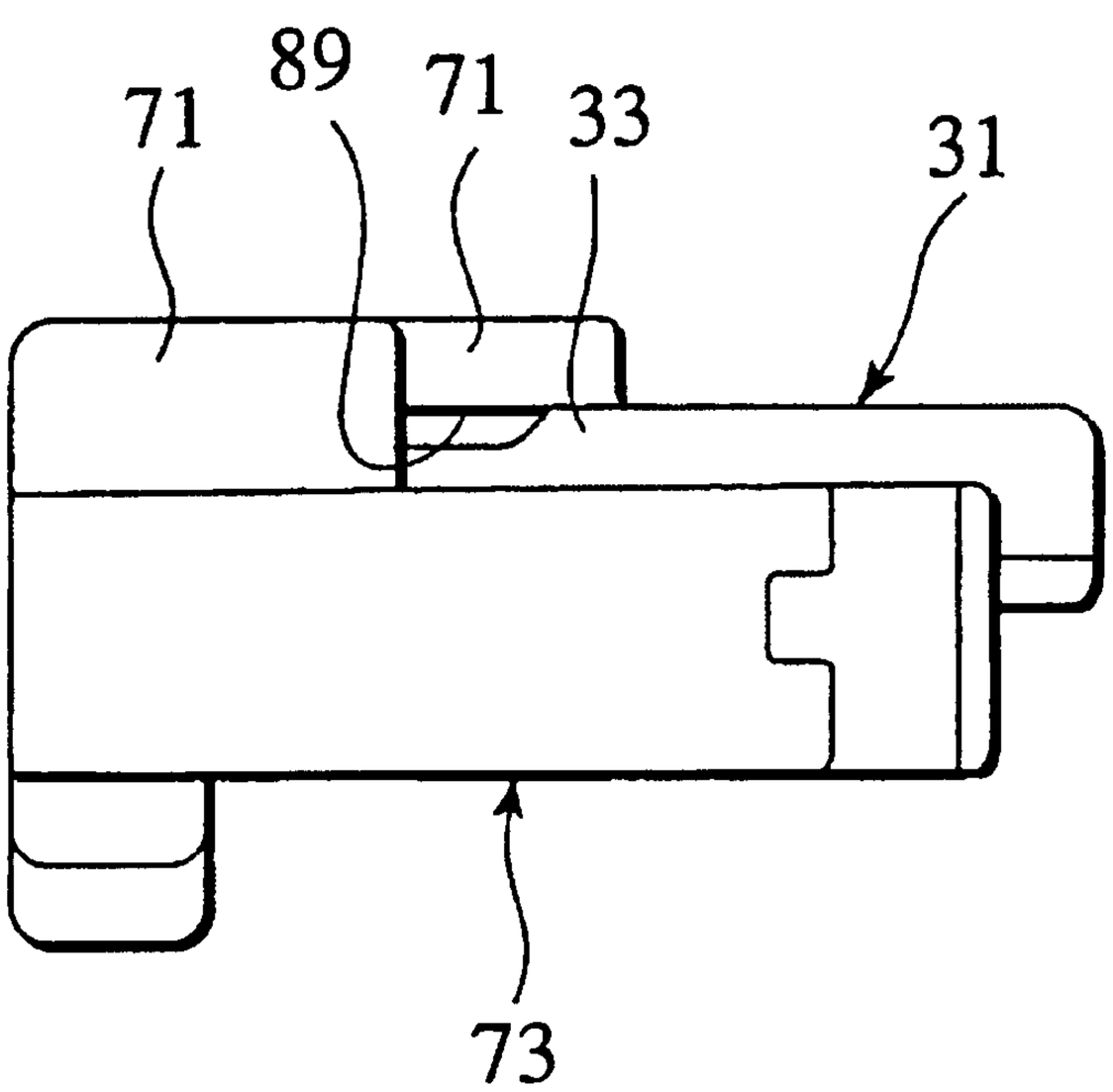


FIG.11

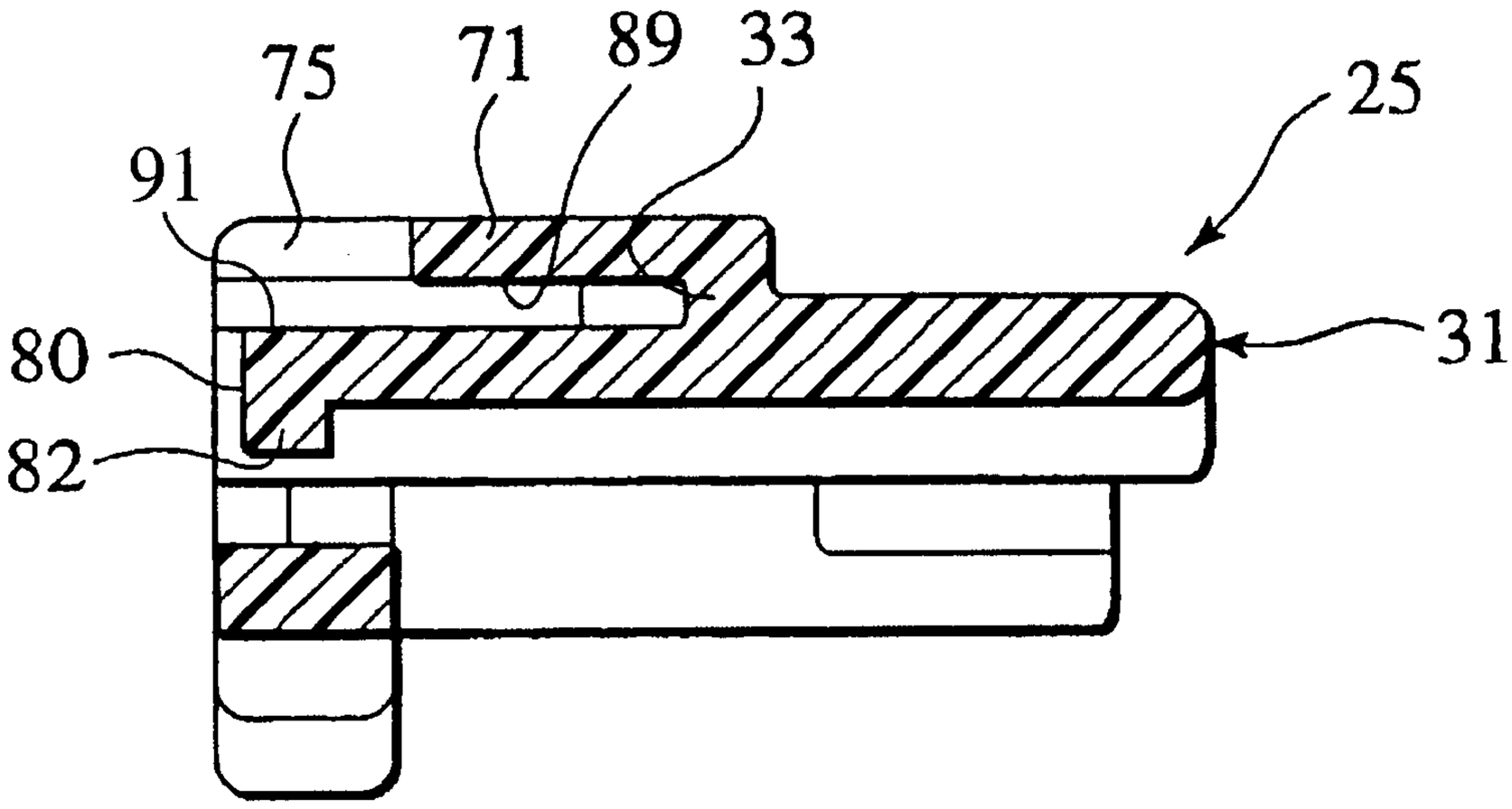


FIG.12

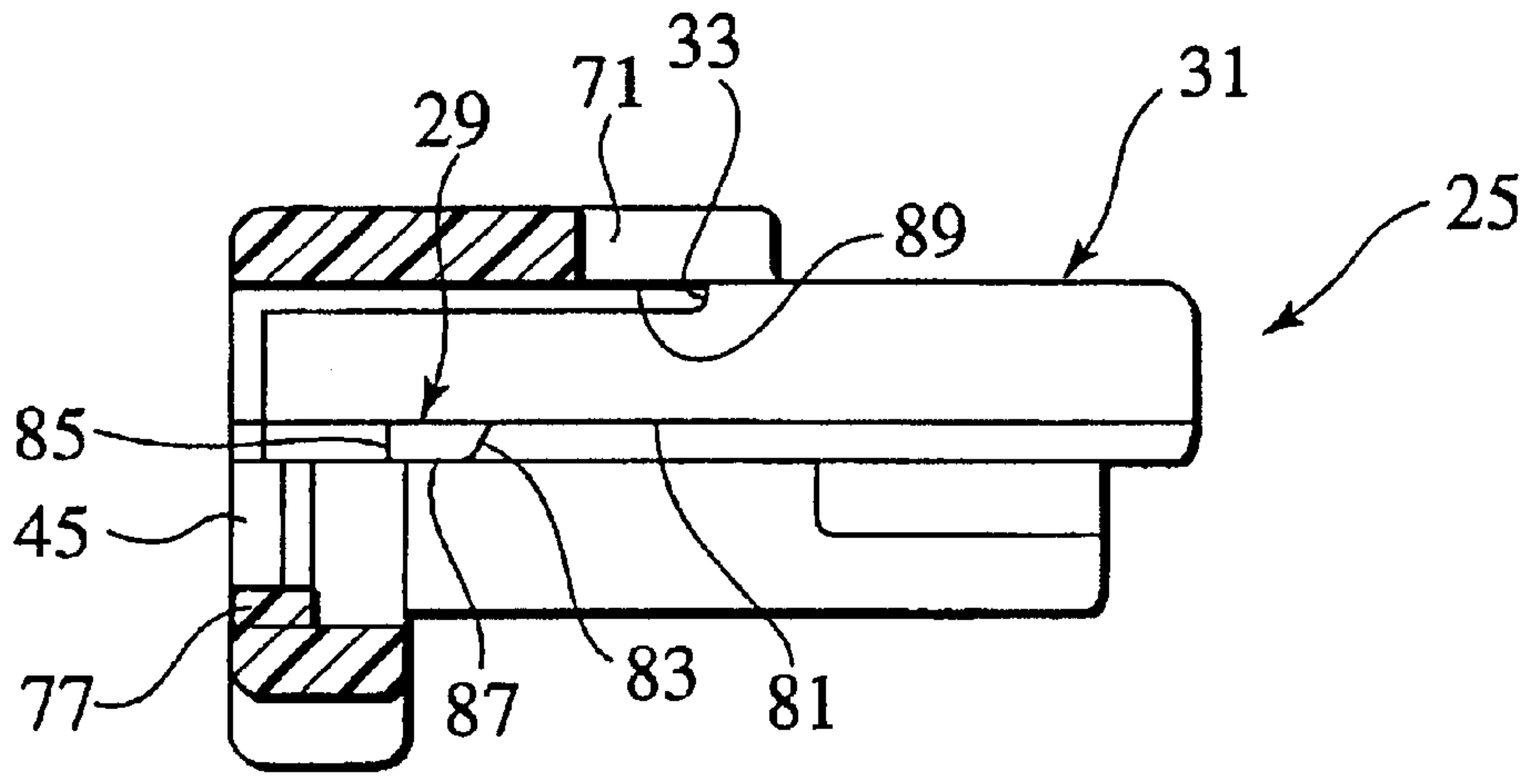
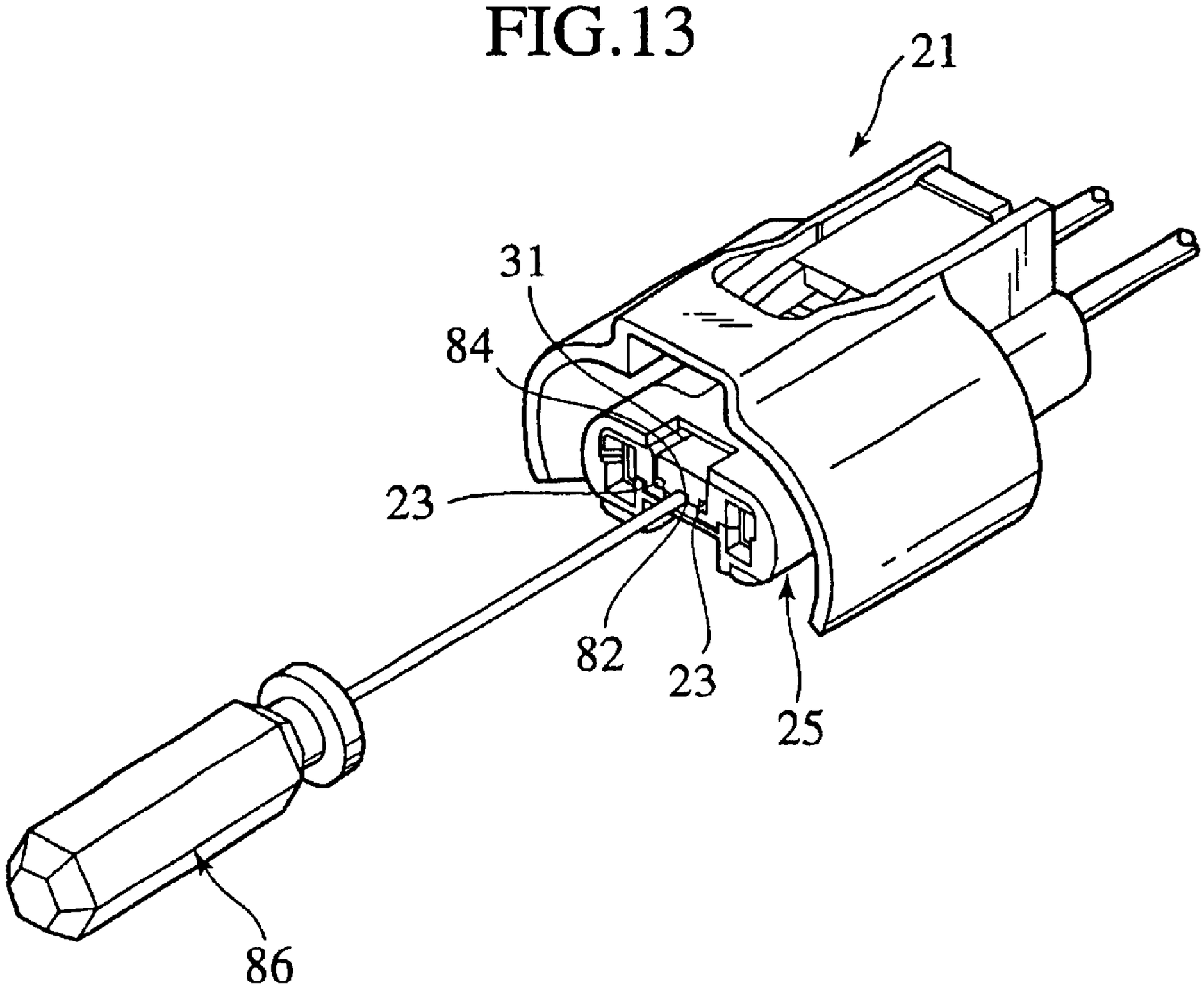


FIG.13



RETAINING STRUCTURE OF FRONT HOLDER TO CONNECTOR HOUSING

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a structure for retaining, to a connector housing, a front holder in an electric wire connector for preventing a terminal from falling off.

2. Description of the Related Art

There is a connector having a housing body including a terminal accommodating chamber for accommodating a terminal therein, and a front holder for preventing the terminal from falling off from the terminal accommodating chamber. Japanese Patent Application Laid-open No. S62-64076 discloses a structure for retaining the front holder to the housing body.

The front holder includes a pair of or a plurality of resilient retaining portions and resilient pieces, and if they are strongly pushed into the housing body, the resilient retaining portions and the resilient pieces are engaged with hooks on the side of a housing, and the front holder is retained to the housing body.

SUMMARY OF THE INVENTION

If a large external force is applied to the above-described front holder, the resilient pieces are bent and engagement with the corresponding hooks on the side of the housing fails. In order to prevent this, the rigidity of the resilient piece must be enhanced but if so, there is a drawback that further large force is required when the front holder is inserted into the housing body, and the operation becomes extremely difficult. Further, if the rigidity of the resilient piece is increased, it is difficult to release the engagement state, it takes time and labor to detach the front holder from the housing body, and there is an adverse possibility that the hooks for retaining the resilient retaining portions and the resilient pieces are damaged.

Thereupon, it is an object of the present invention to provide a retaining structure of a front holder and a connector housing capable of enhancing the operability for retaining the front holder to the housing body, and easily detaching the front holder from the housing body without damaging the front holder.

According to a first aspect of the present invention, the front holder comprises a housing body having a retaining portion, a holding arm having a retaining projection, and a flexible connection portion for supporting the holding arm so that the retaining projection can be engaged with the retaining portion. If the front holder is inserted into the housing body, the holding arm rocks, the retaining projection climbs over the retaining portion, the retaining projection is engaged with the retaining portion, and the front holder is retained to the housing body. In a state where the front holder is retained to the housing body, if a force is applied in a direction releasing the engagement between the front holder and the housing body, the retaining projection abuts against the retaining portion so that the holding arm tries to rock in a direction opposite from the direction releasing the engagement. Therefore, the retained state between the front holder and the housing body is maintained.

According to a second aspect of the present invention, the retaining projection is formed in a direction perpendicular to the inserting direction of the front holder into the housing body, the retaining projection includes an abutment surface which abuts against the retaining portion in a state where the retaining projection is retained to the retaining portion. In a state where the front holder is retained to the housing body, if a force is applied in a direction releasing the engagement between the front holder and the housing body, the retaining projection abuts against the retaining portion. A third aspect of the present invention includes structures of the first and second aspects, and the retaining projection includes a slide guide inner surface which slides on the retaining portion to guide a rocking motion of the holding arm when the front holder is inserted into the housing body.

When the front holder is inserted into the housing body, the slide guide surface slides along the retaining portion to bend the flexible connection portion, thereby rocking the holding arm.

A fourth aspect of the present invention includes structures of the first to third aspects, and in a state where the front holder is retained to the housing body, a space is formed between the housing body and a rear end of the holding arm in the inserting direction inserting the front holder into the housing body.

In the state where the front holder is retained to the housing body, the jig is inserted into the space to rock the holding arm, and the engagement between the retaining projection and the retaining portion can be released.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a front holder and a connector housing body according to a first embodiment of the present invention;

FIG. **2** is a front view of the front holder and the connector housing body of the first embodiment of the invention;

FIG. **3** is a sectional view of the housing body of the first embodiment of the invention taken along a line **3**—**3** in FIG. **2**;

FIG. **4** is a sectional view of the housing body of the first embodiment of the invention taken along a line **4**—**4** in FIG. **2**;

FIG. **5** is a front view of the front holder of the first embodiment of the invention;

FIG. **6** is a rear view of the front holder of the first embodiment of the invention;

FIG. **7** is a plan view of the front holder of the first embodiment of the invention;

FIG. **8** is a sectional view of the front holder of the first embodiment of the invention taken along a line **8**—**8** in FIG. **5**;

FIG. **9** is a sectional view of the front holder of the first embodiment of the invention taken along a line **9**—**9** in FIG. **5**;

FIG. **10** is a side view of the front holder of the first embodiment of the invention;

FIG. **11** is a sectional view of the front holder of the first embodiment of the invention taken along a line **11**—**11** in FIG. **5**;

FIG. **12** is a sectional view of the front holder of the first embodiment of the invention taken along a line **12**—**12** in FIG. **5**; and

FIG. **13** is a perspective view of the housing body and the front holder of the first embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. **1**, **2** and **5**, a retaining structure of a front holder and a connector housing of the first embodiment

of the present invention comprises a housing body **21** having a retaining portion **23**, a housing body **27** of a front holder **25**, a holding arm **31** having a retaining projection **29** engaged with the retaining portion **23** in a state where the retaining projection **29** is retained to the retaining portion **23**, and a flexible connection portion **33** for rockably supporting the holding arm **31** on the housing body **27** at a leading end side of the flexible connection portion **33** in an inserting direction of the later-described front holder **25** into the housing body **21**. In this retaining structure of the front holder, if the front holder **25** is inserted into the housing body **21**, the retaining projection **29** and the retaining portion **23** are engaged with each other.

As shown in FIGS. **1** to **4**, the housing body **21** comprises a plurality of terminal accommodating chambers **35** formed in one end of the housing body **21**, a plurality of terminal inserting portion **37** formed in the other end of the housing body **21**, a holder connecting portion **39** formed between the terminal accommodating chambers **35**, and a fitting hood portion **41** for covering an outer periphery of each of the terminal accommodating chambers **35**.

The terminal accommodating chambers **35** are cylindrically shaped and they are connected to each other. As shown in FIG. **2**, each of the terminal accommodating chambers **35** is formed at its end surface **43** with an insertion port **45** into which a terminal of a mating housing is inserted. A lower side of the end surface **43** is notched.

Further, as shown in FIG. **4**, each the terminal accommodating chamber **35** is provided with an opening **49** passing through a sidewall **47** from its inner peripheral side to its outer peripheral side, and a packing member **48** is tightly connected to the outer peripheral surface. The terminal accommodating chambers **35** include retaining pieces **50** projecting inward from the sidewall **47**.

The retaining piece **50** is of long plate-like shape, one end thereof is formed into an integral shape in one piece with the sidewall **47** of the terminal accommodating chamber **35** thereon, and the other end is a free end in the terminal accommodating chamber **35**. The retaining piece **50** extends along the sidewall **47**, the free end is directed to one end of the housing body **21**, and the free end is engaged with the terminal accommodated in the terminal accommodating chamber **35**. The retaining piece **50** has a gap between an outer surface **51** and an inner peripheral surface of the sidewall **47**.

The housing body **21** is formed in its one end with the terminal accommodating chambers **35** and in the other end with the plurality of terminal inserting portions **37**.

The terminal inserting portions **37** are formed cylindrically, and extend from the terminal accommodating chambers **35** respectively. When the terminals each provided on an end of an electric wire and having a waterproofing plug are inserted into the terminal accommodating chambers **35** respectively, the waterproofing plug comes into tight contact with the inner peripheral surface and makes between the inner peripheral surface and the electric wire waterproof.

As described above, the housing body **21** is provided with the holder connecting portion **39** between the terminal accommodating chambers **35**. As shown in FIGS. **2** to **4**, the holder connecting portion **39** comprises a holding arm-accommodating portion **53** and a plurality of retaining portions **23** provided in the holding arm-accommodating portion **53**. The holding arm-accommodating portion **53** extends along the terminal accommodating chamber **35** and formed from an end of a fitting surface with respect to the mating housing body of the terminal accommodating chamber **35** toward the other end of the housing body **21**. The holding arm-accommodating portion **53** has substantially the same cross sectional shape as that of a later-described holding arm, and the holding arm-accommodating portion **53** accommodate the holding arm **31** in a state where the front holder **25** is retained to the housing body **21**. The holding arm-accommodating portion **53** is provided with a shoulder **57** on an end of a fitting surface with respect to the mating housing body of a bottom surface **55**.

As shown in FIGS. **3** and **4**, the holding arm-accommodating portion **53** is provided at its opposite sides of the bottom surface **55** in its widthwise direction with projections **59** formed along a longitudinal direction. These projections **59** are formed such that and end surface **61** is flush with the end surface **43** of the terminal accommodating chamber **35**. The retaining portion **23** is provided on an upper surface **63** of the projection **59**.

Each of the retaining portions **23** is in a form of a projection, and projects upward from an end on the side of the fitting surface with the mating housing body of the projections **59**. Each of the retaining portions **23** comprises a tapered surface **65** formed on the side of the fitting surface with the mating housing body, an engaging surface **67** formed on a surface opposed to the tapered surface **65**, and an upper surface **69** for connecting the tapered surface **65** and the engaging surface **67** with each other. The tapered surface **65** is a slant surface, one side of the tapered surface **65** is integrally formed on the upper surface **69** of the retaining portion **23**, and the other end is disposed near an interior of the holding arm-accommodating portion **53** from the end surface **61** of the projections **59** with respect to the one side.

As described above, the engaging surface **67** formed on a surface opposed to the tapered surface **65** is formed on a plane in a direction substantially perpendicular to the longitudinal direction of the projection **59**.

The upper surface **69** connecting the engaging surface **67** and the tapered surface **65** to each other connects the other side of the tapered surface **65** and a projecting side of the engaging surface **67** on a plane. Each of the upper surfaces **69** is formed in a direction substantially parallel to an upper surface **63** of the projection **59**, and the upper surface **69** is the strongest portion of the retaining portion **23**.

The fitting hood portion **41** is formed cylindrically, and the fitting hood portion **41** has a gap therein and covers an outer periphery of the terminal accommodating chamber **35**. The fitting hood portion **41** has a rock arm **70**, and when the mating housing body is fitted, the rock arm **70** is engaged with the mating housing body. The front holder **25** is retained to the housing body **21** formed in this manner.

As shown in FIG. **5**, the front holder **25** of this embodiment comprises the housing body **27**, the holding arm **31** having the retaining projection **29** engaged with the retaining portion **23** in a state where the retaining projection **29** is retained to the housing body **21**, and the flexible connection portion **33** for rockably supporting the holding arm **31** on the housing body **27** at the leading end side of the flexible connection portion **33** in the inserting direction of the front holder **25** into the housing body **21**.

As shown in FIGS. **5** to **12**, the housing body **27** comprises a peripheral wall **71** and walls **73** integrally formed on the peripheral wall **71**. The peripheral wall **71** is formed cylindrically, and is provided at its upper portion with a notch **75** notched from one side to the other side so that when the later-described holding arm **31** rocks, the holding arm **31** does not interfere. The peripheral wall **71** is provided a lower

end surface **77** forming a lower side of the insertion port **45** of the terminal accommodating chamber **35** in a state where the front holder **25** is retained to the housing body **21**. The peripheral wall **71** covers outer peripheries of the plurality of terminal accommodating chambers **35** with a fitting surface with respect to the mating housing body in a state where the front holder **25** is retained to the housing body **21**. Each of the walls **73** is integrally formed on the other side of the peripheral wall **71**.

Each of the walls **73** is of long plate-like shape. One of the walls **73** is integrally formed on the peripheral wall **71**, and the other one projects toward a front side of the front holder **25** in an inserting direction to the housing body **21**. The walls **73** close the openings **49** of the terminal accommodating chambers **35** in a state where the front holder **25** is retained to the housing body **21**, and inner surfaces **79** come into contact with outer surfaces **51** of the retaining pieces **50** in the terminal accommodating chambers **35**, thereby restricting motions of the retaining pieces **50**.

The holding arm **31** is of long plate-like shape, its rear end in the fitting direction of the front holder **25** into the housing body **21** in the longitudinal direction is located slightly in front of one end of the peripheral wall **71** in the inserting direction, and the other end of the holding arm **31** projects from the other end of the peripheral wall **71** toward the front end in the inserting direction. As shown in FIGS. **5**, **6**, **8** and **11**, the holding arm **31** has a recessed step **82** on an end surface **80** of the holding arm **31** in the fitting direction of the front holder **25** into the housing body **21**. In a state where the front holder **25** is retained to the housing body **21**, a space **84** is formed between the step **82** and the housing body **21** as shown in FIG. **13**. The holding arm **31** has the retaining projections **29** downwardly projecting from opposite sides of in a widthwise direction of an inner surface **81**.

As shown in FIGS. **5** to **12**, each of the retaining projections **29** is located in front of a rear end of the holding arm **31** in inserting direction of the front holder **25** into the housing body **21** slightly toward this inserting direction. A projecting height of the retaining projection **29** from an inner surface of the holding arm **31** is almost the same as that of the retaining portion **23** of the housing body **21** from the projections **59**. As shown in FIGS. **8** and **12**, each the retaining projection **29** comprises a slide guide surface **83** provided on a front end of the front holder **25** in the inserting direction of the front holder **25** into the housing body **21**, an abutment surface **85** formed on a rear end of the retaining projection **29** in the inserting direction, and a lower surface **87** connecting the slide guide surface **83** and the abutment surface **85** with each other.

The slide guide surface **83** is a flat slant surface, one side of the slide guide surface **83** is connected to an inner surface of the holding arm **31**, and the other side of the slide guide surface **83** is connected to a rear end side of the front holder **25** in the inserting direction thereof into the housing body **21**.

The abutment surface **85** opposed to the slide guide surface **83** of the retaining projection **29** is flat, and perpendicular to the inserting direction of the front holder **25** into the housing body **21** substantially at right angles.

The above-described lower surface **87** is flat, and connects the other side of the slide guide surface **83** and the projecting side of the abutment surface **85**. The lower surface **87** extends substantially in parallel to the bottom surface **55** of the holding arm-accommodating portion **53**, and the lower surface **87** is the lowest portion of the retaining projection **29**.

As shown in FIGS. **10** to **12**, the flexible connection portion **33** rockably supporting the holding arm **31** on the housing body **27** connects an inner peripheral surface **89** of an upper portion of the other side of the peripheral wall **71** and an intermediate portion of an outer side surface **91** of the holding arm **31** to each other. The flexible connection portion **33** supports the holding arm **31** on a front end side of the flexible connection portion **33** in the inserting direction of the front holder **25** into the housing body **21** with respect to the retaining projection **29**.

When the front holder **25** is to be retained to the housing body **21**, the front holder **25** is inserted into the housing body **21** to bring the retaining projection **29** and the retaining portion **23** into engagement with each other.

When the front holder **25** is to be inserted into the housing body **21**, the other end of the holding arm **31** in its longitudinal direction is aligned to the holding arm-accommodating portion **53** of the housing body **21**. Then, if the front holder **25** is inserted into the housing body **21**, the sidewall **47** forming the opening **49** of the terminal accommodating chamber **35** and the wall **73** of the front holder **25** are engaged with each other, and the slide guide surface **83** of the retaining projection **29** and the tapered surface **65** of the retaining portion **23** are abutted against each other.

In this state, if the front holder **25** is further inserted into the housing body **21**, since the slide guide surface **83** of the retaining projection **29** pushes the tapered surface **65** of the retaining portion **23**, the holding arm **31** receives its reaction force. Therefore, the holding arm **31** rocks around the flexible connection portion **33** as a fulcrum such that portion of the holding arm **31** closer to the end surface **80** is displaced upward.

If the front holder **25** was inserted to a position where the front holder **25** is retained to the housing body **21**, the retaining projection **29** climbs over the retaining portion **23**, the flexible connection portion **33** is restored by its own resiliency, and the holding arm **31** is accommodated in the holding arm-accommodating portion **53** as a whole.

As a result, the abutment surface **85** of the retaining projection **29** and the engaging surface **67** of the retaining portion **23** are engaged with each other, and the front holder **25** is retained to the housing body **21**. At that time, the upper surface **69** of the retaining portion **23** and the inner surface **81** of the holding arm **31** are abutted against each other, and the lower surface **87** of the retaining projection **29** and the upper surface **63** of the projections **59** are abutted against each other.

Each the wall **73** closes the opening **49**, the inner surface **79** comes into contact with the outer surface **51** of the retaining piece **50** in the terminal accommodating chamber **35** to restrict the movement of the retaining piece **50**, thereby retaining the terminal accommodated in the terminal accommodating chamber **35**.

In a state where the front holder **25** is retained to the housing body **21**, if a force in a direction to release the retaining state between the front holder **25** and the housing body **21** is applied, the abutment surface **85** of the retaining projection **29** abuts the engaging surface **67** of the retaining portion **23**, and the retaining projection **29** receives a reaction force from the retaining portion **23**. Therefore, a force in a direction to displace a portion of the holding arm **31** closer to the end surface **80** around the flexible connection portion **33** as a fulcrum is applied to the holding arm **31**.

At that time, since the inner surface **81** is in abutment against the upper surface **69** of the retaining portion **23** and the lower surface **87** of the retaining projection **29** is in

abutment against the upper surface **63** of the projections **59** of the housing body **21**, displacement of the holding arm **31** is restricted and rocking motion is prevented. Thus, the retaining state between the front holder **25** and the housing body **21** is reliably maintained.

When the front holder **25** is to be detached from the housing body **21**, the engagement between the retaining portion **23** and the retaining projection **29** is released by a jig **86** as shown in FIG. **13**.

At that time, one end of the jig **86** is inserted into the space **84**. Next, the other end of the jig **86** is displaced downward around an end of the bottom surface **55** on the side of the fitting surface with respect to the housing body as a fulcrum. Subsequently, jig **86** pressurize an end surface of the recessed step **82** and connects the flexible connection portion **33** As a result, a portion of the holding arm **31** on the side of the end surface **80** is upwardly displaced and rocked around the flexible connection portion **33** as the fulcrum, and the engagement between the retaining projection **29** and the retaining portion **23** is released. In this state, a force in a direction releasing the retained state of the retaining projection **29** to the housing body **21** is applied to the front holder **25**, and the front holder **25** is detached from the housing body **21**.

As described above, according to the retaining structure of the front holder of this embodiment, when a force in a direction releasing the retained state of the retaining projection **29** to the housing body **21** is applied to the front holder **25** in the state,where the front holder **25** is retained to the housing body **21**, the end surface **80** tried to be displaced downward around the flexible connection portion **33** as the fulcrum. At that time, the inner surface **81** is in abutment against the upper surface **69** of the retaining portion **23** and the lower surface **87** of the retaining projection **29** is in abutment against the upper surface **63** of the projections **59**, the displacement of the holding arm **31** is restricted and the rocking motion can be prevented, and the retained state between the front holder **25** and the housing body **21** can reliably be maintained.

Thus, it is possible to lower the rigidity of the flexible connection portion **33**, and the holding arm **31** can rock easily when the front holder **25** is to be inserted into the housing body **21** and when the front holder **25** is to be detached from the housing body **21**.

Therefore, a force required for inserting the front holder **25** into the housing body **21** is reduced, which makes it easy to retain the front holder **25** to the housing body **21**. Further, the front holder **25** can easily be detached from the housing body **21**, and the front holder **25** can be prevented from being damaged.

In the state where the front holder **25** is retained to the housing body **21**, even if a force in the direction releasing the engagement between the front holder **25** and the housing body **21** is applied, since the abutment surface **85** abuts against the engaging surface **67** to prevent engagement between the front holder **25** and the housing body **21** from being released, the engagement is reliably maintained.

Further, when the front holder **25** is to be inserted into the housing body **21**, the slide guide surface **83** of the retaining projection **29** slides on the retaining portion **23** and the rocking motion of the holding arm **31** is guided, the retaining portion **23** and the retaining projection **29** can be engaged with each other only by inserting the front holder **25**. Therefore, the front holder **25** can be retained to the housing body **21** easier.

According to the retaining structure of the front holder of the present embodiment, it is possible to insert the jig into the space **84** to rock the holding arm **31** in the state where the front holder **25** is retained to the housing body **21**. Therefore, the front holder **25** can easily be detached from the housing body **21**.

What is claimed is:

1. A retaining structure of a front holder to a connector housing comprising;

a connector housing including a holder connecting portion having a retaining portion; and

a front holder, including;

a holding arm having a retaining projection; and

a flexible connection portion for supporting said holding arm so that said retaining projection can be engaged with said retaining portion;

wherein said flexible connection portion supports said holding arm on a front end of said flexible connection portion in an inserting direction of said front holder into said connector housing with respect to said retaining projection; and

said retaining projection is configured to be engaged with said retaining portion and is configured to be accommodated within said holder connecting portion in a state where said front holder is retained to said connector housing.

2. A retaining structure of a front holder and a connector housing according to claim **1**, wherein

said retaining projection is formed in a direction perpendicular to said inserting direction of said front holder into said connector housing; and

said retaining projection includes an abutment surface which abuts against said retaining portion in a state where said retaining projection is retained to said retaining portion.

3. A retaining structure of a front holder and a connector housing according to claim **1**, wherein

said retaining projection includes a slide guide surface which slides on said retaining portion to guide a rocking motion of said holding arm when said front holder is inserted into said connector housing.

4. A retaining structure of a front holder and a connector housing according to claim **1**, wherein

in a state where said front holder is retained to said connector housing, a space is formed between said connector housing and a rear end of said holding arm in said inserting direction inserting said front holder into said connector housing so that a jig can be inserted from said rear end into said space to disengage said retaining projection from said retaining portion.

5. A retaining structure of a front holder and a connector housing according to claim **1**, wherein said connector housing comprises a fitting hood portion covering an outer periphery of said holder connecting portion.

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